



USAID
FROM THE AMERICAN PEOPLE



STEM Workbook



Cover photo caption: Students from Ghana International School listen attentively to a presentation on women in STEM who have made significant contributions to their field. The presentation is part the of the Power Africa's West Africa Girls in STEM Webinar series.

Photo credit: Ghana International School

DISCLAIMER

This Workbook is made possible through the support of the American People through the United States Agency for International Development (USAID). The contents of this Workbook are the sole responsibility of Deloitte Consulting LLP and do not necessarily reflect the views of USAID or the United States Government. This Workbook was prepared under Contract Number 720-674-19-F-00008.

INTRODUCTION

This interactive Science, Technology, Engineering, and Mathematics (STEM) workbook is meant to serve as a resource for the youth to learn more about the importance of STEM and the variety of exciting opportunities that exist, all while highlighting successful women who have charted a path in the field. The workbook includes hands on activities to encourage young students to explore skills linked to the different career paths.

Topics from this workbook were derived from a STEM survey administered in August 2022 by Power Africa, to various secondary schools in West Africa to (i) determine what influences the youth's career aspirations; (ii) validate if stereotypes about STEM are still pervasive among today's more tech-savvy youth; and (iii) identify ways to encourage increased engagement of girls in STEM fields. The results and analysis of the survey was published on [Power Africa's blog platform](#).

Power Africa regularly hosts STEM webinars in schools across the region to showcase women who are in the STEM career path or pursuing STEM degrees to inspire girls to pursue careers in the STEM fields.

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AN OVERVIEW OF STEM

WHAT IS STEM?

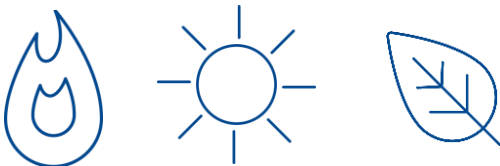
An acronym that stands for:

Science
Technology
Engineering
Mathematics

WHY IS STEM IMPORTANT?

STEM teaches us about the world around us. STEM is an interactive, hands-on, and fun way to learn how to make your community a better place. Without STEM knowledge, we wouldn't have:

- **Music**, so we could dance
- Bicycles, cars, motorbikes, or **buses** to take us places
- **Telephones**, to call our friends



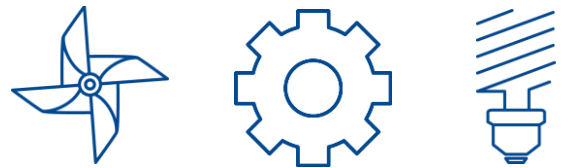
WHO CAN WORK IN STEM?

ANYONE!

Learn more about some common myths to girls in STEM [here](#)

WHAT KIND OF JOBS ARE IN STEM?

- Help your friends read in the dark as an **Electrical Engineer**
- Put together cellphone apps as a **Software Developer**
- Create medicine to keep your family healthy as a **Biomedical Engineer**
- Build bridges and roads as a **Civil Engineer**
- Study insects and bugs as an **Entomologist**



WHAT COOL THINGS ARE STEM PROFESSIONALS DOING?

- **Inventing** smart technologies to improve energy access
- **Discovering** new planets and galaxies
- **Creating** water purification technologies to increase access to clean water

THE UN SUSTAINABLE DEVELOPMENT GOALS

WHAT ARE THE UNITED NATION SUSTAINABLE DEVELOPMENT GOALS?

They are a universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere. The 17 Goals were adopted by all UN Member States in 2015, as part of the 2030 Agenda for Sustainable Development.

THE 17 GOALS:

1. No Poverty
2. Zero Hunger
3. Good Health and Well-Being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation, and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice, and Strong Institutions
17. Partnerships for the Goals

WHY DO THE GOALS MATTER?

- The states that comprise the West Africa region are all UN Member States
- Careers in [STEM](#) play a role in [achieving](#) many of the goals in West Africa
- Science, technology, engineering, and mathematics (STEM) careers worldwide are [lacking female participation](#), but female participation is necessary for the Sustainable Development Goals to be met



STEM CAREERS NEEDED TO HELP ACHIEVE SUSTAINABLE DEVELOPMENT GOALS

- Renewable Energy Engineer
- Electrical Engineer
- Water Conservation Specialist
- Climatologist
- Agricultural Scientist
- Food Technologist
- Civil Engineer
- Geothermal Engineers
- Ecologist
- Horticulturalist

INTERSECTION OF STEM AND ENERGY

WHY IS THE ENERGY SECTOR IMPORTANT?

The energy sector enhances the ability for all other sectors – health, education, finance, agriculture, etc., to exist and thrive. In fact, [Goal 7 of the Sustainability Goals](#) is to, “ensure access to affordable, reliable, sustainable, and modern energy for all.” Without access to electricity, we wouldn’t be able to have:

- **Cellphones** to communicate with our friends and family
- The ability to research our favorite subject on **the internet**
- Perform life saving medical care with **medical devices**
- **Lights** on at night to do your homework

WHY SHOULD WOMEN AND GIRLS ENTER STEM AND ENERGY?

One reason growth in the energy sector and progress toward Goal 7 has slowed is due to **a talent gap**. Properly trained professionals with a background in STEM are limited. In order to close the talent gap the energy sector needs a pipeline of STEM-educated people. We know that there is a shortage of women and girls entering STEM fields for a number of reasons, a few that are highlighted in this [article](#), but exposure and access to STEM education should not be one of those reasons.

It is imperative that more individuals, **especially women and girls, enter STEM fields** in order to create a pipeline of future energy engineers to help provide access to sustainable energy for all. Projects like USAID’s Power Africa recognize the need for women and youth to gain a background in STEM so that electrification projects across Africa can see the light of day and succeed. That is why this STEM Workbook exists, along with events such as [West African Girls in STEM Webinars](#).

WHAT IS POWER AFRICA?

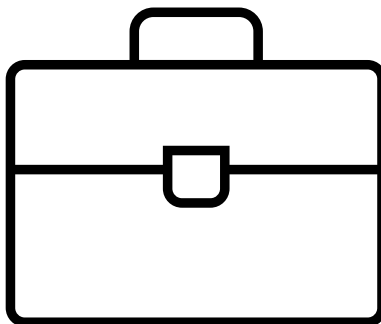
[Power Africa](#) is a U.S. Government-led partnership that works with private companies, international development organizations, and governments to increase **energy access** and to **end energy poverty** in sub-Saharan Africa. Since its inception Power Africa has established 3.4 million new electricity connections to help power homes, businesses, schools, and hospitals. As an example, Power Africa assisted the Bui Power Authority (BPA) in Ghana, with operationalizing West Africa’s [first solar-hydro hybrid plant](#), a project that combines renewable energy from solar to complement the existing hydropower production. This exciting project generates electricity while cutting greenhouse gas emissions by more than 47,000 tons per year.



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SECTION I: Careers in STEM



SCIENCE CAREERS: PHYSICIST

PHYSICIST

Physics is a foundational natural science that helps us understand relationships in the universe. A physicist studies the universe and everything in it in order to identify the basic principles that govern the structure and behavior of the items.

TYPES OF CAREERS

- [Accelerator Operator](#)
- [Acoustic Physicist](#)
- [Aerospace Engineer](#)
- [Astronomer](#)
- [Astrophysicist](#)
- [Design Engineer](#)
- [Infrared Sensor Engineer](#)
- [Laser Engineer](#)
- [Materials Scientist](#)
- [Medical Physicist](#)
- [Nuclear Physicist](#)
- [Process Engineer](#)
- [Quantitative Research Analyst](#)
- [Quantum Scientist](#)
- [Solar Physicist](#)
- [Space Operations Specialist](#)
- [Systems Analyst](#)
- [Technical Specialist](#)

TYPES OF DAY-TO-DAY WORK

- Monitor equipment used in nuclear experiments and power generation
- Write scientific papers for publication
- Design new telescopes and lasers
- Discover new planets in distant solar systems
- Use computer software to develop virtual models of different designs
- Operate, test, or maintain robotic equipment
- Discover new properties of matter and energy through conducting experiments

KEY ATTRIBUTES

- **Investigative**
- **Artistic**
- **Extroversion**

ROLE MODELS

- [Marie Korsaga](#)
- [Francisca Nneke Okeke](#)

SCIENCE CAREERS: BIOLOGY

BIOLOGY

Biology is the study of living things in order to help us understand the world around us. Scientists who work in this field aim to utilize their findings from studying humans, plants, and animals to make advances in our quality of life and to protect the environment.

TYPES OF CAREERS

- [Biochemist](#)
- [Biofuel Engineer](#)
- [Biomedical Engineer](#)
- [Clinical Laboratory Scientist](#)
- [Conservationist](#)
- [Environmental Scientist](#)
- [Forestry Technician](#)
- [Geneticist](#)
- [Marine Biologist](#)
- [Medical Laboratory Technician](#)
- [Medical Doctor](#)
- [Microbiologist](#)
- [Natural Resources Specialist](#)
- [Neuroscientist](#)
- [Optical Laboratory Specialist](#)
- [Pathologist](#)
- [Physical Scientist](#)
- [Psychologist](#)

TYPES OF DAY-TO-DAY WORK

- Clean polluted sources of water
- Develop new medicines to cure diseases
- Protect plants and animals
- Improve sustainability in livestock/crops
- Teach students
- Write and publish scientific reports
- Design and implement experiments
- Limit spread of infectious diseases
- Help combat climate change through land conservation

KEY ATTRIBUTES

- **Investigative**
- **Enterprising**
- **Social Responsibility**

ROLE MODELS

- [Wangari Muta Maathai](#)
- [Dr. Gassou Amivi Kafui Epse Tete-Benissan](#)

TECHNOLOGY CAREERS: CYBER

CYBER

Cyber is focused on the internet, and how to protect computers and networks from security threats. The field is vast, growing, and can include making advancements in technologies such as artificial intelligence, machine learning, and other remote command of machines.

TYPES OF CAREERS

- [Chief Information Officer](#)
- [Computer Systems Analyst](#)
- [Cyber Threat Analyst](#)
- [Cyber Network Defender](#)
- [Cyber Operations Specialist](#)
- [Cyber Security Trainer](#)
- [Cyber System Engineer](#)
- [Cyber Warfare Technician](#)
- [Cryptographer](#)
- [Forensics Expert](#)
- [Information Systems Security](#)
- [Intelligence Analyst](#)
- [Security Analyst](#)
- [Security Architect](#)
- [Security Engineer](#)

TYPES OF DAY-TO-DAY WORK

- Oversee an organization's technology needs
- Protect national security through maintaining secure networks
- Help team members solve their technology issues
- Train users in the proper use of hardware and software
- Reconstruct cyber crimes
- Prepare reports that document general metrics, attempted attacks, and security breaches
- Design plans and layouts for data communication networks

[KEY ATTRIBUTES](#)

- **Conventional**
- **Investigative**
- **Social Responsibility**

ROLE MODELS

- [Odunayo Eweniyi](#)
- [Eloho Oname](#)
- [Ethel Coffie](#)

ENGINEERING CAREERS: ENGINEER

ENGINEER

Engineers use skills in STEM to design and build solutions to tough problems in a variety of industries. Engineers solve a range of complex problems such as: how to make airplanes more fuel efficient, how to clean water, how to squeeze toothpaste out of a tube, or how to build a skyscraper.

TYPES OF CAREERS

- [Aerospace Engineer](#)
- [Agricultural Engineer](#)
- [Automotive Engineer](#)
- [Biofuels Engineer](#)
- [Chemical Engineer](#)
- [Civil Engineer](#)
- [Electrical Engineer](#)
- [Environmental Engineer](#)
- [Geological Engineer](#)
- [Industrial Engineer](#)
- [Marine Engineer](#)
- [Mechanical Engineer](#)
- [Nanotechnology Engineer](#)
- [Nuclear Engineer](#)
- [Optical Engineer](#)
- [Paper Engineer](#)
- [Petroleum Engineer](#)
- [Robotics Engineer](#)
- [Software Engineer](#)
- [Structural Engineer](#)
- [Systems Engineer](#)

TYPES OF DAY-TO-DAY WORK

- Ensure that designs of products meet engineering principles, environmental regulations, and client requirements
- Develop and test prototypes of devices
- Design and plan the layout of manufacturing equipment
- Analyze the results of soil testing to develop strategies to produce better yields for crops
- Determine the best building materials – wood, asphalt, steel, or concrete, to use for a projects
- Design new ways to provide electricity to homes and businesses

KEY ATTRIBUTES

- **Investigative**
- **Enterprising**
- **Extraversion**

ROLE MODELS

- [Eunice Biritwum](#)
- [Monica Senanu](#)

MATHEMATICS CAREERS:

MATHEMATICIAN

MATHEMATICIAN

Mathematics, or Math, is the study of numbers, shapes, and patterns. Mathematics can be studied on its own or be applied to other disciplines such as physics and engineering. Some who works in the field of math is called a Mathematician.

TYPES OF CAREERS

- [Accountant](#)
- [Actuary](#)
- [Application Developer](#)
- [Auditor](#)
- [Biostatistician](#)
- [Computer Programmer](#)
- [Cryptologist](#)
- [Data Analyst](#)
- [Data Scientist](#)
- [Data Systems Specialist](#)
- [Economist](#)
- [Engineer](#)
- [Financial Analyst](#)
- [Intelligence Analyst](#)
- [Market Researcher](#)
- [Mathematician](#)
- [Meteorologist](#)
- [Operations Research](#)
- [Programmer](#)
- [Risk Analyst](#)
- [Software Developer](#)
- [Statistician](#)
- [Systems Analyst](#)

TYPES OF DAY-TO-DAY WORK

- Design surveys and experiments to collect data
- Design studies to test efficacy of medicines
- Help inform government policy and law makers about the economic impacts of laws and regulations through detailed mathematical analysis
- Utilize data to help clients understand their customer needs
- Report current weather conditions
- Develop new software to help solve problems
- Design new ways to power cars

[KEY ATTRIBUTES](#)

- **Investigative**
- **Conventional**
- **Extraversion**

ROLE MODELS

- [Grace Alele-Williams](#)
- [Marie Françoise Ouedraogo](#)

HOW STEM CAREERS ARE UTILIZED IN THE ENERGY SECTOR

PHYSICISTS

Physicists can find a home in the energy sector. The educational background received as a physicist allows one to break down complex problems, which is important in the energy field. More practically speaking physicists are often hired in the energy sector – solar, wind, and nuclear to continue to make advancements in the types of materials used to create energy to improve efficiencies. An example would be in the solar power industry where physicists are finding new materials to use for solar panel generation.

BIOLOGISTS

Biologists can play various roles in the energy sector. One major way biologists are shaping the energy sector is by applying biological principals to create new and improve current sustainable energy solutions. Biology is even being used to provide safe use of nuclear energy and enhance the way we collect and store solar power. To produce energy, you need land for the power grid. Biologists can help ensure that engineers protect vital ecological biospheres through providing expert advice and recommendations.

CYBER

The energy sector is continually facing cyber attacks that impact the supply of energy and can disrupt the economy. It is a dilemma that requires strong cyber security across the supply chain. Cyber security specialists can help design a cyber strategy that can protect the energy sector and ensure the continued supply of electricity to the end users. Due to the importance of the energy sector to the economy threats to its security will not decline anytime soon, and individuals with a cyber background are needed in the energy sector now more than ever.

HOW STEM CAREERS ARE UTILIZED IN THE ENERGY SECTOR

ENGINEER

Engineers play a crucial role in the energy sector. They help develop systems that facilitate energy generation in a safe and efficient way. Engineers in the energy sector may support with various project aspects such as construction, operations, and maintenance. The demand for engineers in the energy sector is growing and is not expected to drop. The energy sector will continue to need engineers for grid planning, making advancements in sustainability, and developing solutions for various projects.

MATHEMATICIAN

Mathematics are the cornerstone of many other scientific fields. Mathematicians are valuable to the energy sector by helping to make advancements to sustainable energy. They help develop efficient designs through their modelling, simulation, and other mathematical mechanisms. Mathematical models can help predict the amount of energy needed at any time, and the optimal ways to meet the demand. Mathematicians are hired across the energy sector in areas such as renewable energy generation, energy demand forecasting and energy dispatching.

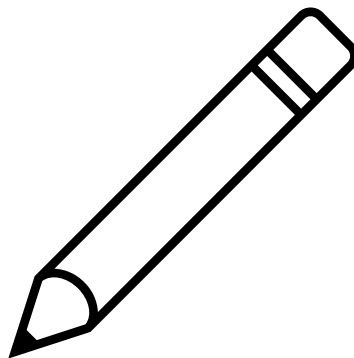


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SECTION 2:

STEM Activities



THE SCIENTIFIC METHOD

Scientists study the world around us and try to understand how and why things happen. Have you ever asked what clouds are made of, or why the sky is blue? Well then you are a scientist. Scientists follow a series of steps, called the Scientific Method, to figure out the answers to the questions that they have.

Following the 6 Steps of Scientific Method can help you find the answer to a question that makes you curious.

1



Observation

Things are happening all around us. Find something that makes you curious.

2



Question

What would you like to know about your observation? Why do you want to know it?

3



Hypothesis

What do you think is the answer to your question? Can you test it? What do you think will happen?

4



Experiment

Design and perform an experiment to test your hypothesis. Collect data from your results.

5



Record Results

Analyze the responses found. See if it matches your hypothesis and make a conclusion.

6



Share Results

What did you learn? Was your prediction, right? Do you have new questions?

MY SCIENTIFIC METHOD JOURNAL

1



Observation

Things are happening all around us. Find something that makes you curious.

2



Question

What would you like to know about your observation? Why do you want to know it?

3



Hypothesis

What do you think is the answer to your question? Can you test it? What do you think will happen?

MY SCIENTIFIC METHOD JOURNAL

4



Experiment

Design and perform an experiment to test your hypothesis. If you can't test it, ask around/research if an experiment has already been done by someone else, or if an answer has already been found and demonstrated. Collect data from your results.

5



Record Results

Analyze your data or the responses that you found. See if it matches your hypothesis and make a conclusion.

6



Share Results

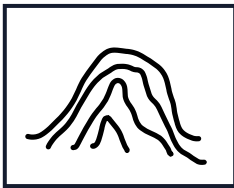
What did you learn? Was your prediction right? Do you have new questions?

IN PRACTICE: BIOLOGY

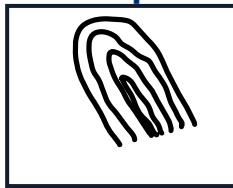
EXAMINING YOUR FINGERPRINTS

Fingerprints are unique to you and have been used as a way to identify people perhaps as early as **300 B.C, in China**. A person's fingerprints are based on patterns of skin ridges on the pads of the fingers, and the patterns of skin ridges are called **dermatoglyphs**. Fingerprinting is one form of biometrics, and they are used because they are easy to collect, they never change, they are easy to analyze, and are unique to each person. There are three main features that can be found in our fingerprint dermatoglyphs – arches, whorls, and loops.

Arches



Loops



Whorls



Your fingerprints have a combination of ridge lines that may feature these distinctive patterns. These ridge lines collect oils and dirt, and as you touch items you may leave behind your unique fingerprints.

HOW TO EXAMINE YOUR FINGERPRINTS

What You Need:

- Marker, pen or ink pad - dark colored (black, blue, brown)
- Piece of paper or this workbook page - light-colored (white)
- OPTIONAL, a magnifying glass

How To Get Your Prints:

1. Choose which finger you want to use to take the print
2. Open your source of ink
 - **Marker/Pen:** Use the marker/pen to color the pad of your chosen finger
 - **Ink Pad:** Dip the pad of your chosen finger on the ink pad
3. Take the inked finger pad and press it firmly on the piece of paper until the ridges from your finger can be seen on the paper (see the next page for the fingerprinting journal)
4. Wash your hands
5. Observe your fingerprint with the magnifying glass, if you have one, or your eyes
6. Write down which types of patterns you are observing – Arches, Loops, and/or Whorls

IN PRACTICE: BIOLOGY

FINGERPRINT OBSERVATIONS

The three main features that can be found in our fingerprints – arches, whorls, and loops.

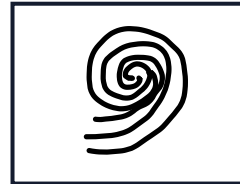
Arches



Loops



Whorls



FINGERPRINT

OBSERVATIONS

FINGERPRINT

OBSERVATIONS

IN PRACTICE: CYBER

BINARY CODING

In technology, binary codes are used to encode data. A binary code acts as a written language for computer processors to execute different actions. It is called binary code because it uses a two-symbol system from the binary number system – “0” and “1”. “0” and “1” are used to assign a pattern of binary digits to each character of instruction for the computer to “read” and then perform the task. The basis for binary code was invented by Gottfried Leibniz. Most modern computers use binary encoding for instructions and data. Think about all a computer can perform – all of that is done through a series of “0” and “1”.

These complex tasks are achieved through reading a bit. A bit is short for Binary Digits. For example, 101001 is a Binary Number. A “bit” is a single binary digit. The number 101001 has 6 bits.

EXAMPLE OF A BINARY CODE

A	01000001	J	01001010	S	01010011
B	01000010	K	01001011	T	01010100
C	01000011	L	01001100	U	01010101
D	01000100	M	01001101	V	01010110
E	01000101	N	01001110	W	01010111
F	01000110	O	01001111	X	01011000
G	01000111	P	01010000	Y	01011001
H	01001000	Q	01010001	Z	01011010
I	01001001	R	01010010		

IN PRACTICE: CYBER

HOW TO USE BINARY CODE

What You Need:

- A writing utensil
- A piece of paper of this workbook page
- The binary code alphabet

Directions:

1. Use the activity cards to practice utilizing binary code
2. Once you understand how to utilize binary code write a secret message to your friend

BINARY CODE ACTIVITY CARDS

EXAMPLE

H	01001000
I	01001001
HI	0100100001001001

IN PRACTICE: CYBER

BINARY CODE ACTIVITY CARDS

I

H	
E	
L	
L	
O	
HELLO	

ANSWERS ARE ON PAGE 35

BINARY CODE ACTIVITY CARDS

2

S	
T	
E	
M	
STEM	

ANSWERS ARE ON PAGE 36

IN PRACTICE: CYBER

BINARY CODE ACTIVITY CARDS

3

	01000110
	01010101
	01001110
	010001100101010101001110

ANSWERS ARE ON PAGE 37

IN PRACTICE: ELECTRICAL ENGINEER

CONDUCTING ELECTRICITY

Electricity, or electrical energy, is created from moving electrons. Electricity flows through conductors, but it can't flow through insulators. For the electrons to move and to power our lights/electronics a closed circuit is needed. The movement of electrons in a targeted direction to create a positive charge is known as **an electrical current**. An electric current gives us electricity to power our homes, schools, and businesses.

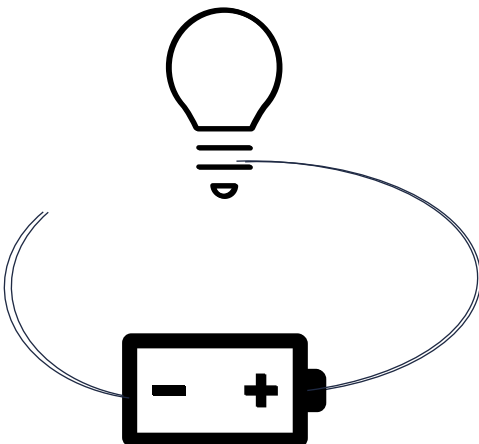
CONDUCTORS AND INSULATORS

Conductors allow energy to pass. Examples of conductors are metals, water, or people. **Insulators** do not allow energy to pass through. Examples of insulators are rubber, plastic, glass, or wood.

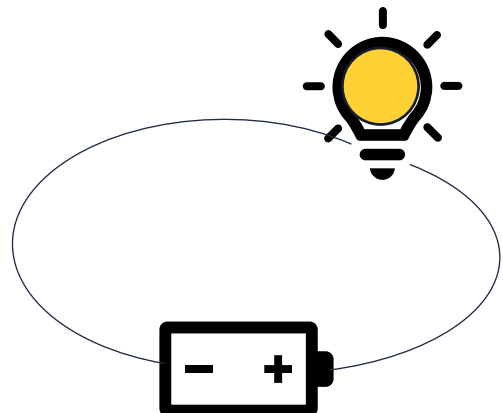
CIRCUITS

Closed circuits allow electrons to flow through to create electricity. **Open circuits** stop the flow of electrons and do not create electricity.

Open Circuit



Closed Circuit



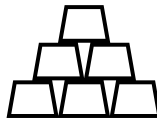
IN PRACTICE: ELECTRICAL ENGINEER

CONDUCTOR OR INSULATOR

Circle all of the items that are **conductors** below. Remember a conductor allows energy to pass while an insulator does not allow energy to pass.



Nails/Screws



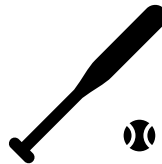
Gold



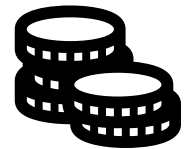
Silver Key



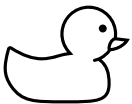
Water



Wooden
Baseball Bat



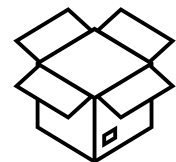
Copper Coins



Rubber Duck



Diamond



Cardboard Box



Plastic Water Bottle

ANSWERS ARE ON PAGE 38

IN PRACTICE: MATHEMATICIAN

ARCHIMEDES OSTOMACHION PUZZLE

Archimedes was an ancient Greek mathematician, physicist, engineer, astronomer, and inventor. He is known to have many mathematical achievements, such as the [approximation of pi](#). He is also known for creating a mathematical game known as Archimedes Ostomachion puzzle. The game is a 14-piece dissection puzzle forming a square. One way to play the game is to take the pieces of the square to create different objects, animals, and plants. It has been determined that the square can be arranged in to [17,152 different images](#).

A similar puzzle is [Tangram](#). Tangram is a geometric puzzle that consists of seven pieces that form one square. The seven pieces are then arranged to create different patterns.

TANGRAM

The seven pieces of the tangram square can be used to create the various shapes on a tangram card. The tangram cards feature images such as fish, camels, rabbits, foxes, etc.

Printable Tangram Puzzles and Cards can be found here:

https://etc.usf.edu/clipart/74400/74405/74405_tangram_w_lg.gif

However, a few tangram activities are featured on the subsequent pages of this workbook.

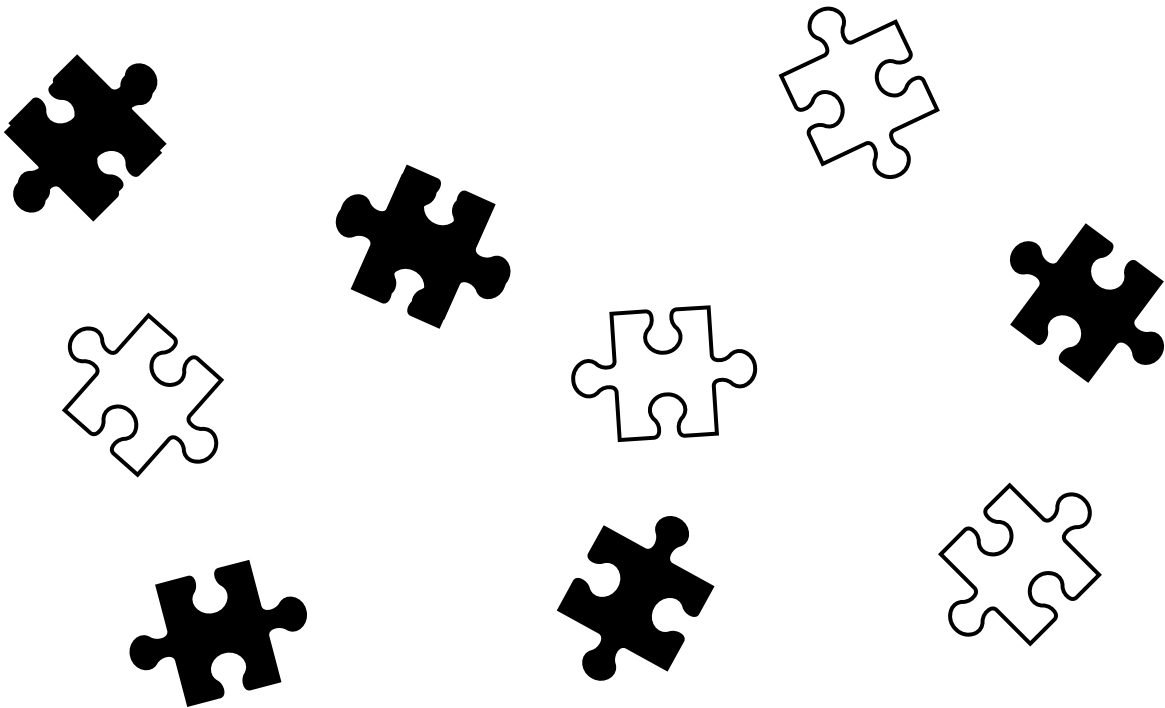
TANGRAM

What You Need:

- The Tangram Square Pattern
- Scissors
- Printed out Pattern and Tangram Cards

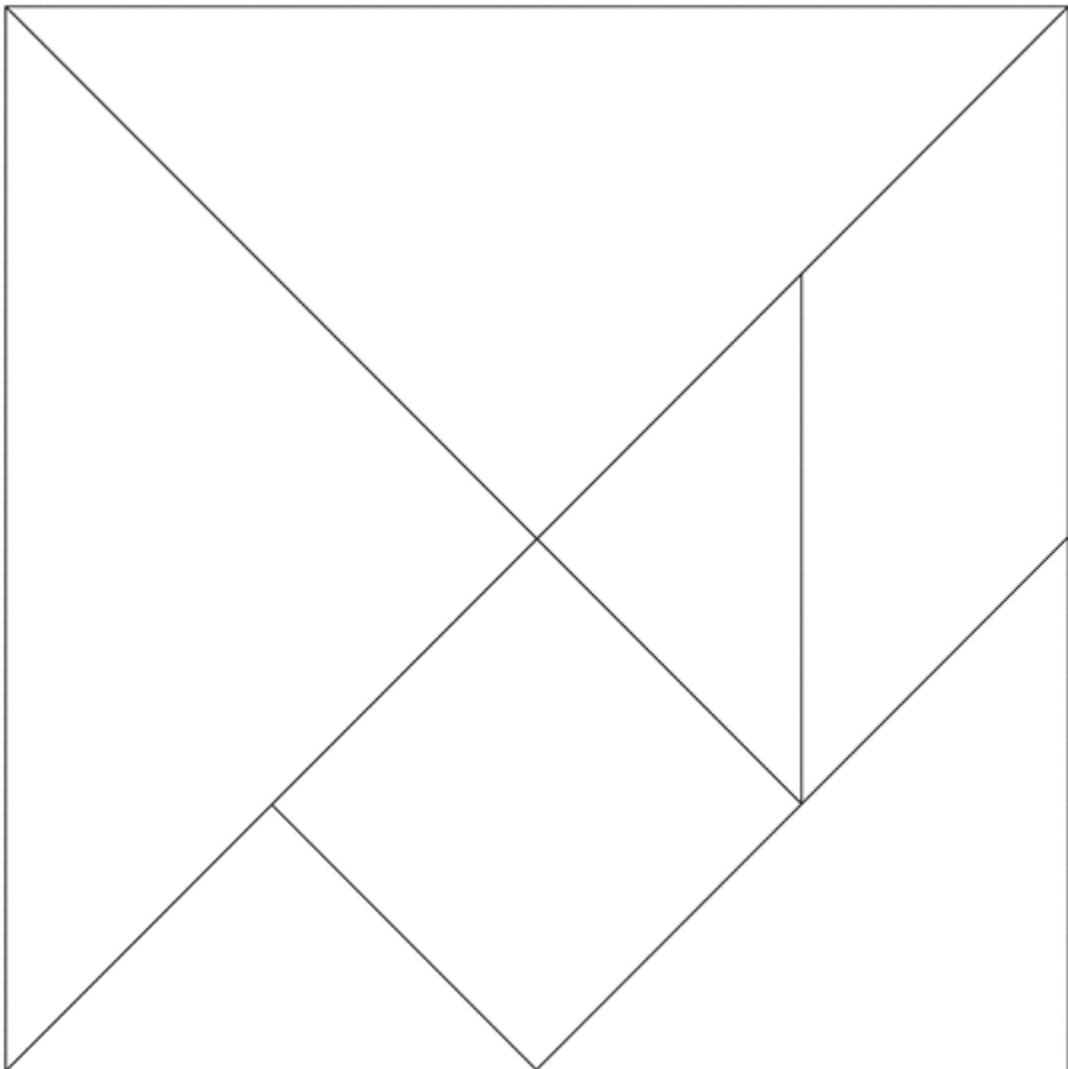
Steps:

1. Use the scissors to cut out the Tangram Pattern on the next page
2. Once you have each of the seven shapes use them to create the pattern on each of the Tangram Cards
3. Find the answers to each of the Tangram Cards in the Answer Key Section at the end of this workbook



TANGRAM

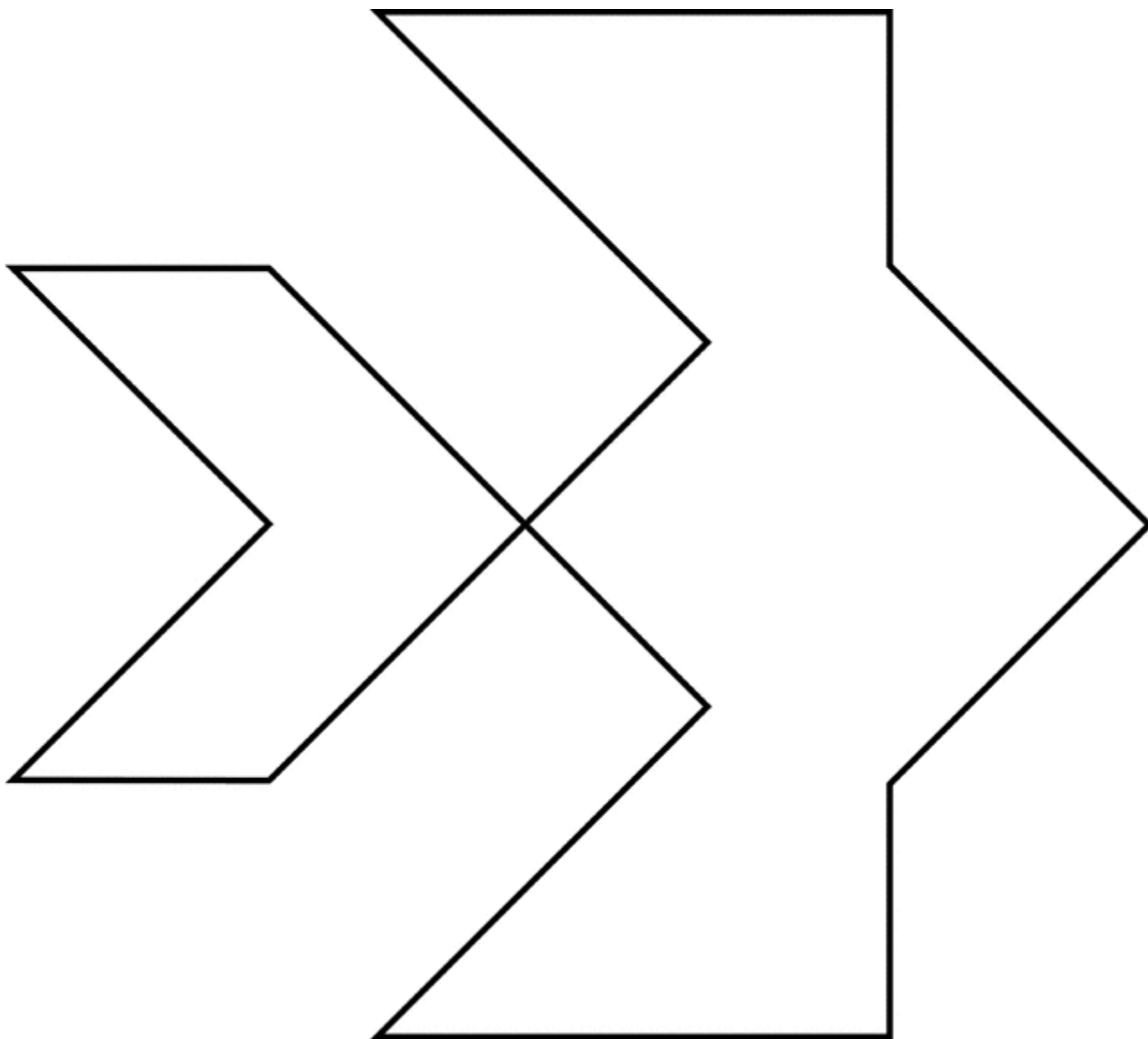
TANGRAM



DIRECTIONS: Carefully cut along the lines above to create the seven pieces of a tangram puzzle set.

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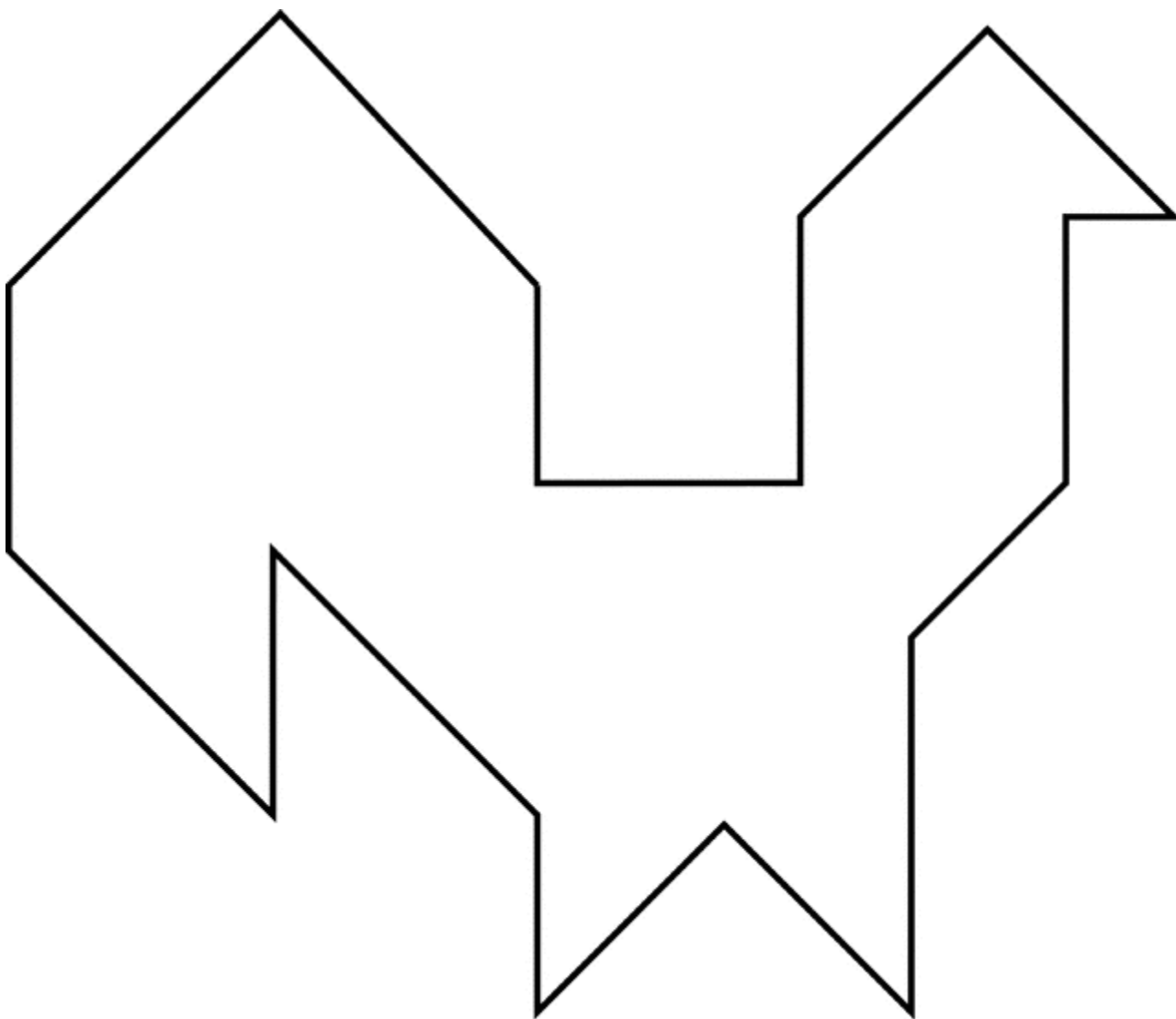
TANGRAM CARD I: BETA FISH



ANSWERS ARE ON PAGE 39

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TANGRAM CARD 2: ROOSTER

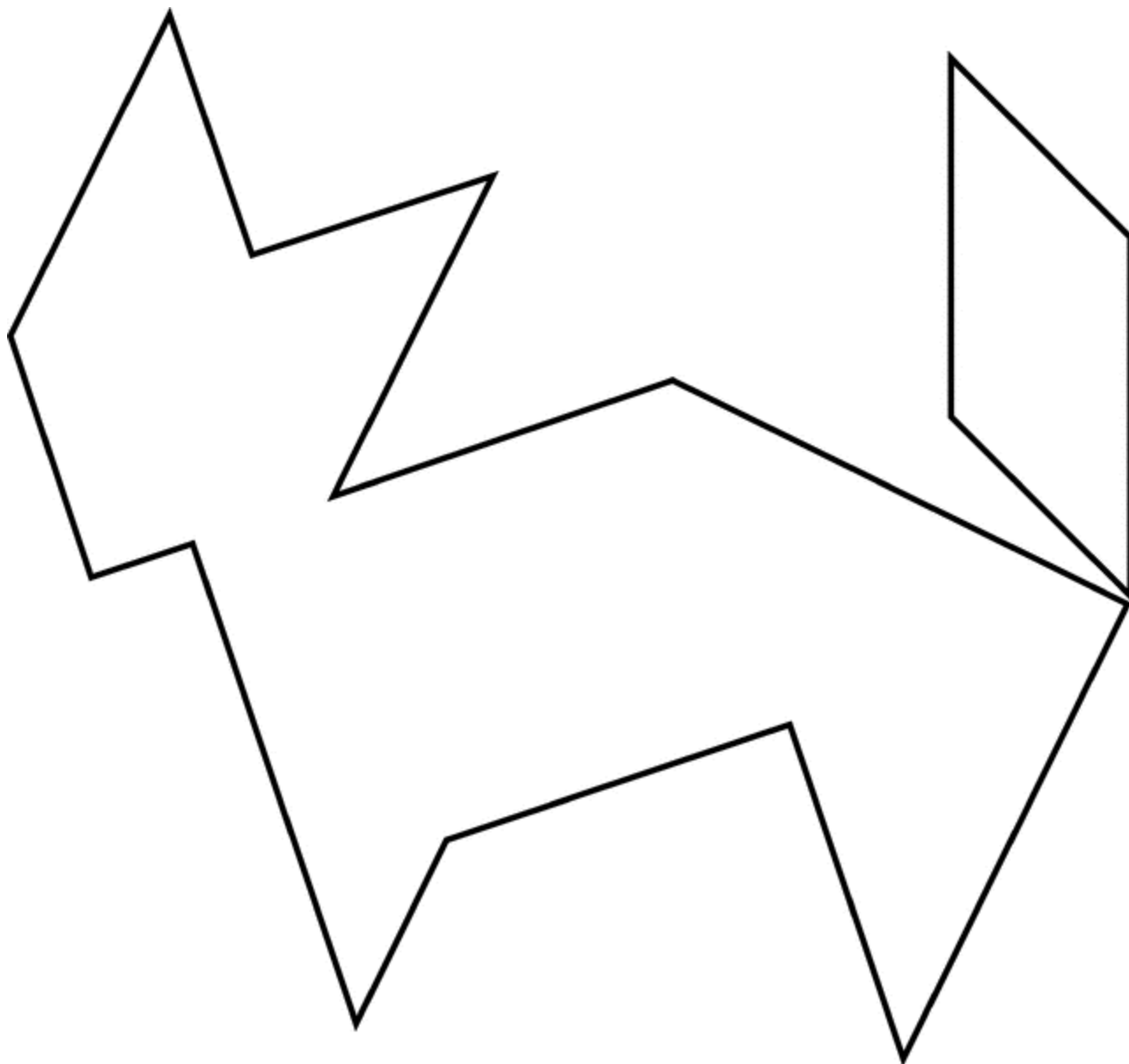


ANSWERS ARE ON PAGE 40

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IN PRACTICE: MATHEMATICIAN

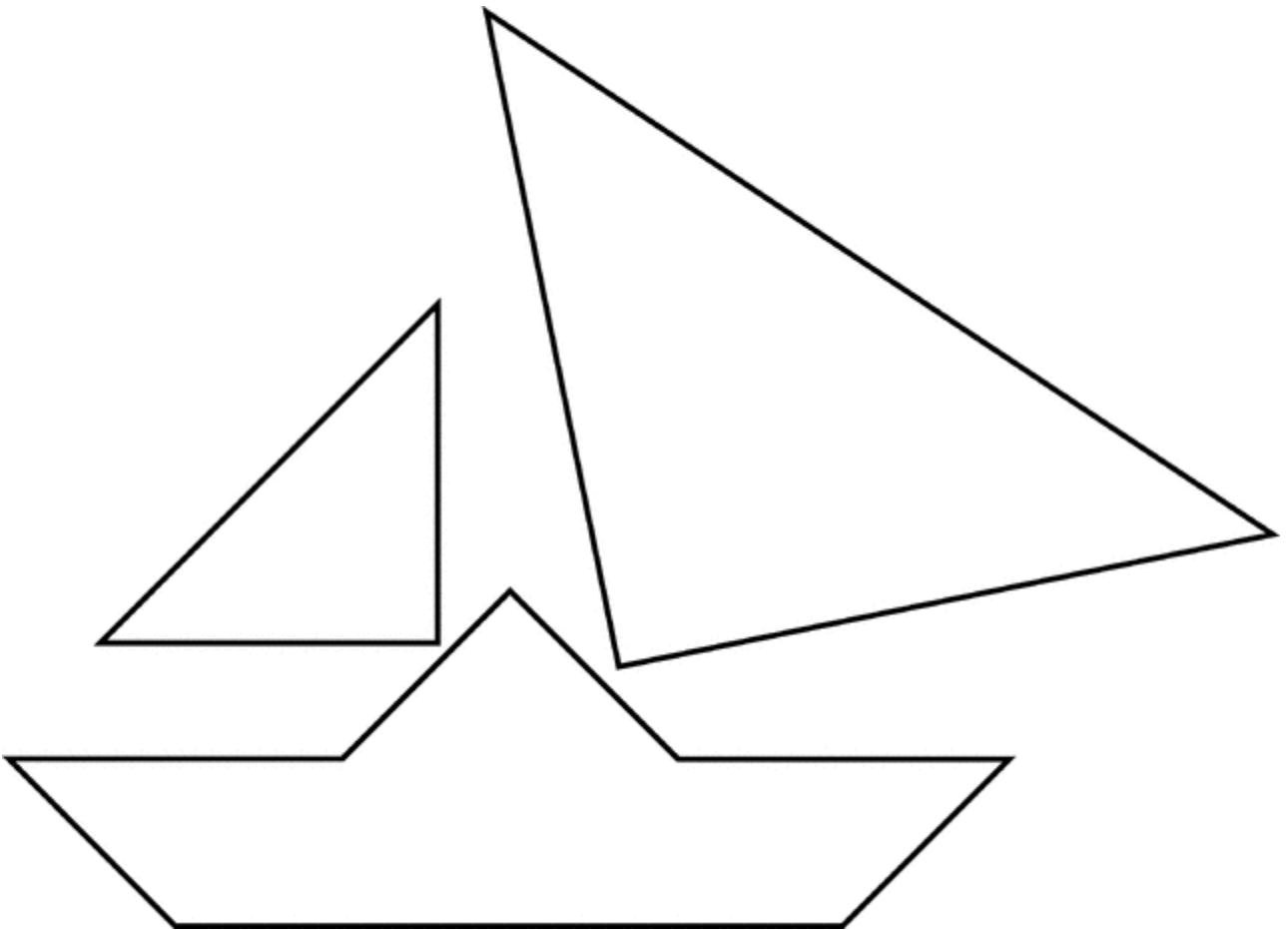
TANGRAM CARD 3: STANDING FOX



ANSWERS ARE ON PAGE 41

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TANGRAM CARD 4: SAILBOAT



ANSWERS ARE ON PAGE 42

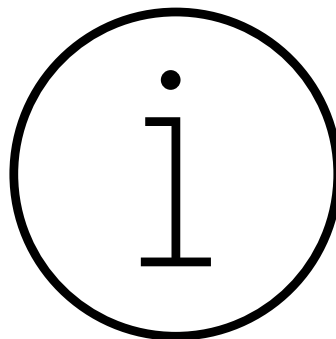
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SECTION 3: STEM Activities Answer Key



ANSWER KEY: CYBER

BINARY CODE ANSWER CARDS

I

H	01001000
E	01000101
L	01001100
L	01001100
O	01001111
HELLO	010010000100010101001100 0100110001001111

ANSWER KEY: CYBER

BINARY CODE ANSWER CARDS

2

S	01010011
T	01010100
E	01000101
M	01001101
STEM	01010011010101000100010101001 101

ANSWER KEY: CYBER

BINARY CODE ANSWER CARDS

3

F	01000110
U	01010101
N	01001110
FUN	010001100101010101001110

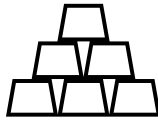
ANSWER KEY: ELECTRICAL ENGINEER

CONDUCTOR OR INSULATOR

Circle all of the items that are **conductors** below. Remember a conductor allows energy to pass while an insulator does not allow energy to pass.



Nails/Screws



Gold



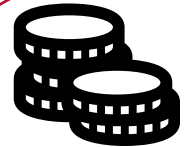
Silver Key



Wooden
Baseball Bat



Water



Copper Coins



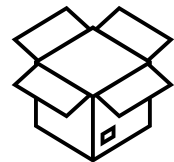
Diamond



Rubber Duck



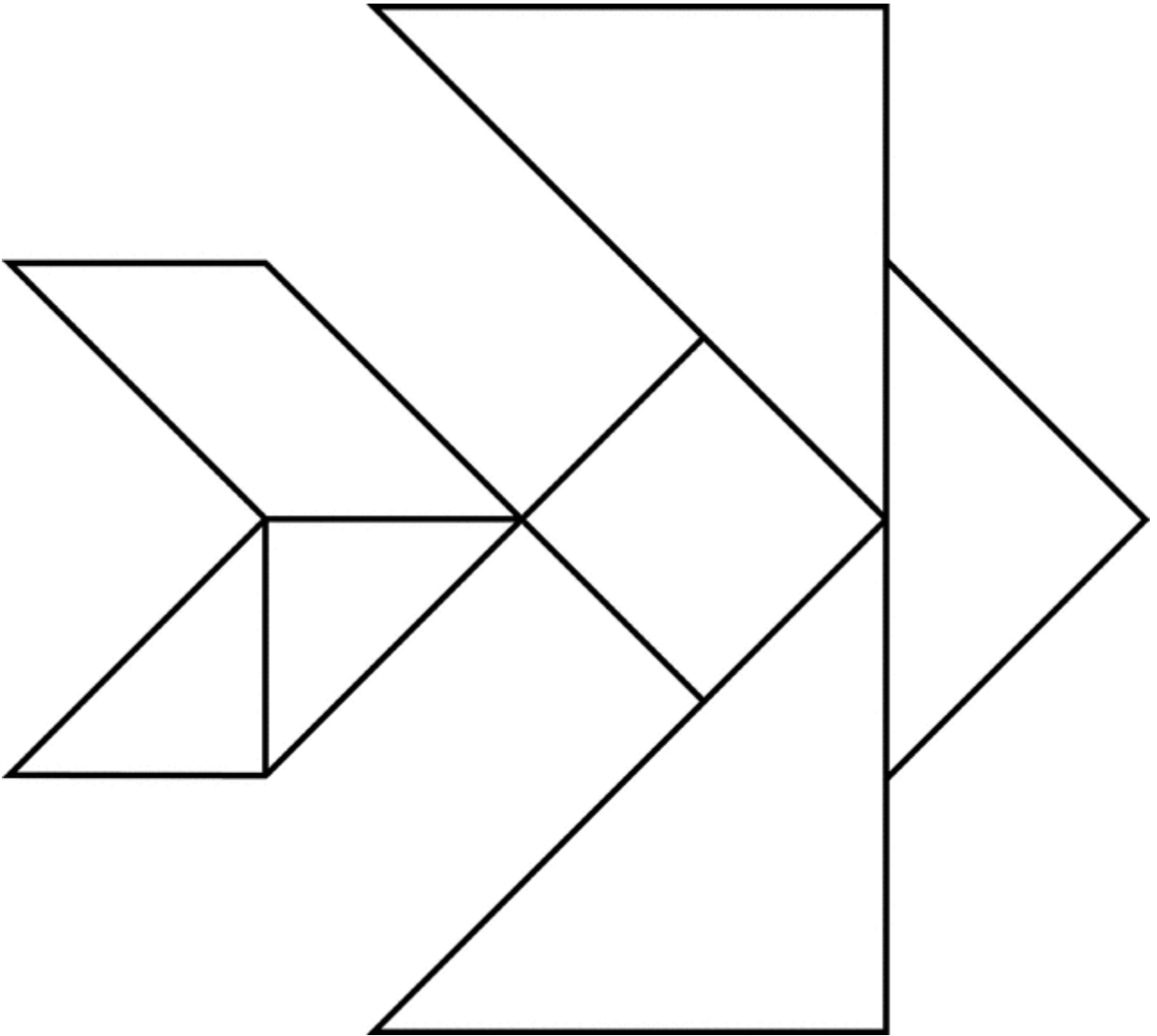
Plastic Water Bottle



Cardboard Box

ANSWER KEY: MATHEMATICIAN

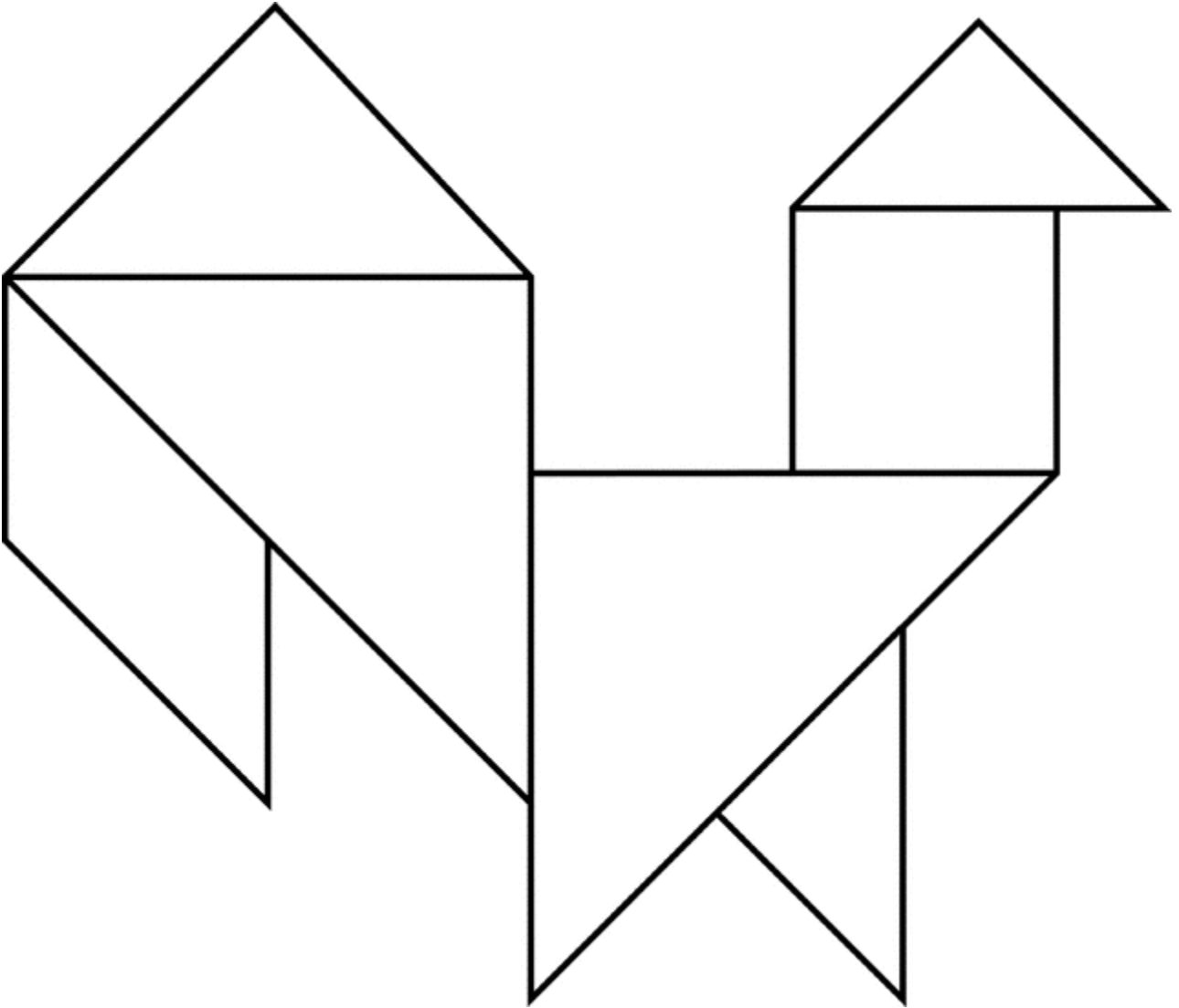
TANGRAM CARD I: BETA FISH



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ANSWER KEY: MATHEMATICIAN

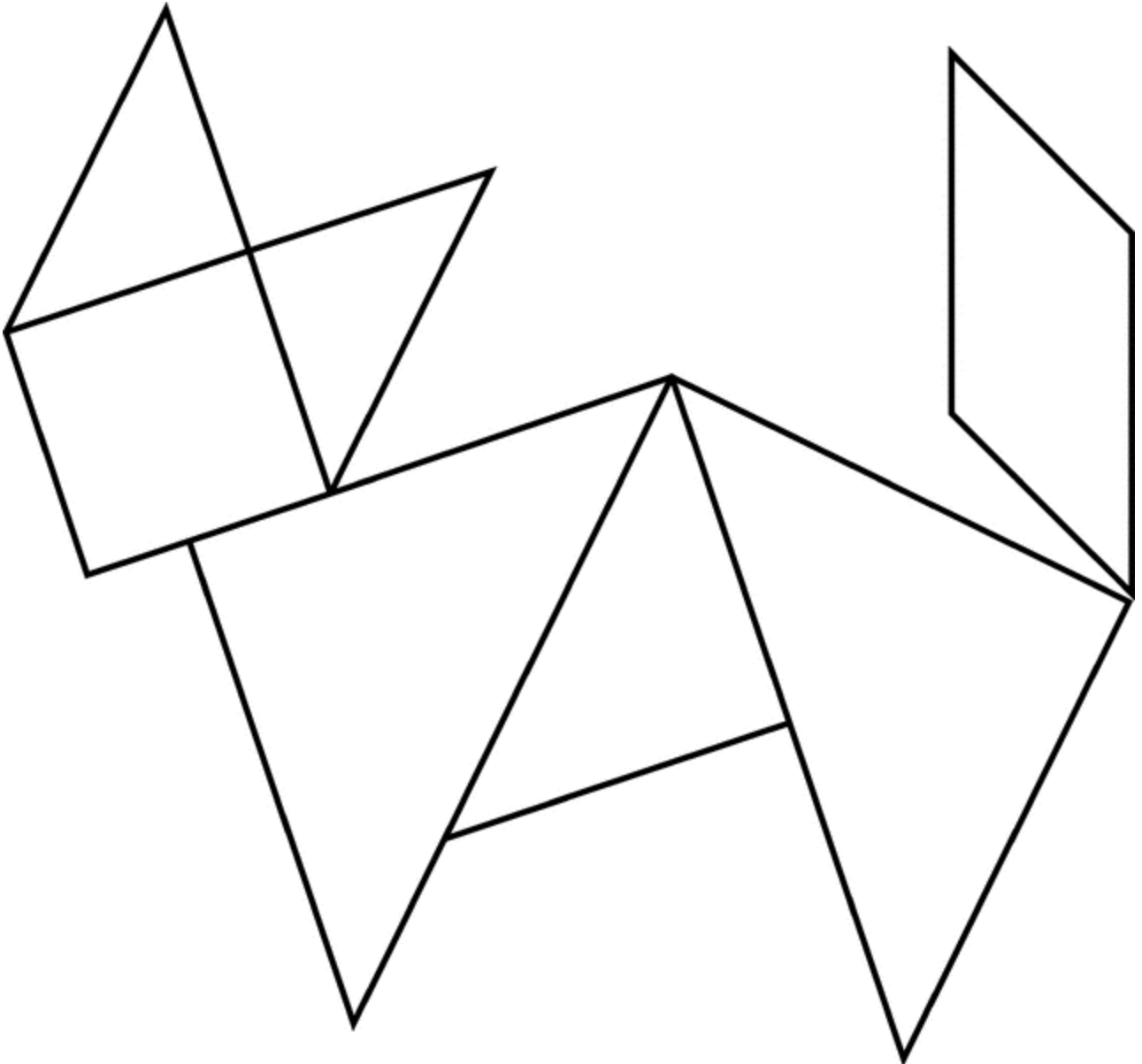
TANGRAM CARD 2: ROOSTER



Made Available from [this Website](#)

IN PRACTICE: MATHEMATICIAN

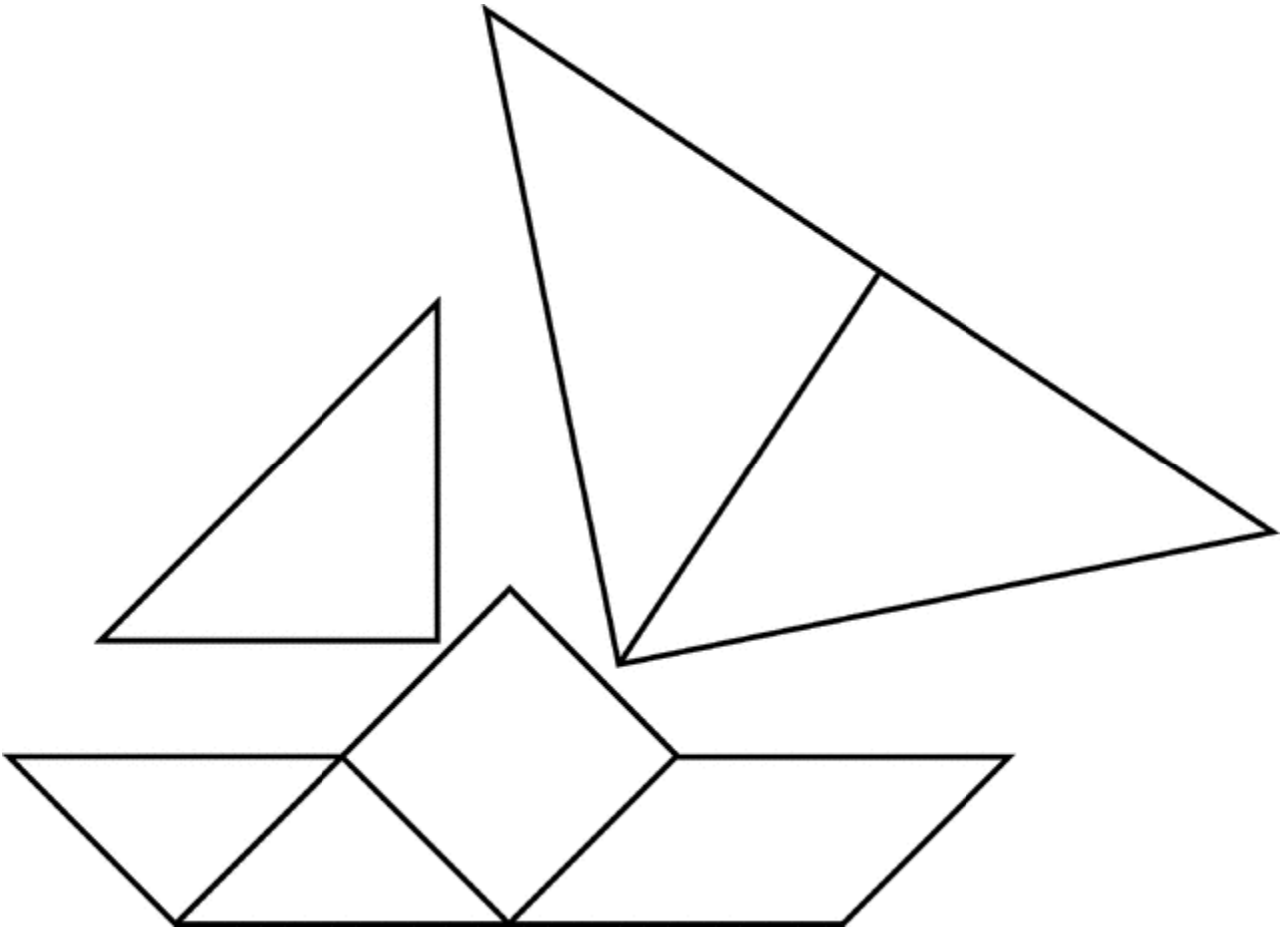
TANGRAM CARD 3: STANDING FOX



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ANSWER KEY: MATHEMATICIAN

TANGRAM CARD 4: SAILBOAT



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SECTION 4:

STEM Role Models



STEM ROLE MODELS



Marie Korsaga

- First female astrophysicist in West Africa
- Completed her PhD in astrophysics at the University of Cape Town
- PhD research was on 'The distribution of dark and visible matter in spiral and irregular galaxies.'
- From Burkina Faso and plans to build planetariums in her home country to give presentations

STEM ROLE MODELS



Francisca Nneka Okeke

- A Nigerian physicist
- Was the first female Head of Department of Physics and Astronomy at the University of Nigeria as well as the first Dean of the Faculty of Physical Sciences
- In 2011, she was elected as a fellow of the Nigerian Academy of Science
- She has dedicated her career to studying the ionosphere and the equatorial electrojet phenomenon
- Her research on solar activity in the ionosphere could lead to advancements in identifying sources of climate change phenomena like tsunamis and earthquakes

STEM ROLE MODELS



Wangarĩ Muta Maathai

- From Kenya, Maathai was the first woman in East and Central Africa to earn a doctorate degree
- In 1977, Maathai founded the Green Belt Movement, an organization focused on planting trees to promote environmental conservation and women's rights
- She was also an elected member of the Parliament of Kenya from 2003 – 2005
- Maathai authored several books and made significant contributions to thinking about ecology, development, and gender in Africa
- In 2004, she became the first African woman to win the Nobel Peace Prize

STEM ROLE MODELS



Dr. Gassou Amivi Kafui Epse Tete-Benissan

- A Togolese PhD researcher in pharmaceutical and biological sciences
- Teaches cell biology and biochemistry at the University of Lomé in Togo
- Works with the Togolese Women for the Promotion of Science and Technology to help improve Togolese girls' secondary and university level performance in STEM subjects

STEM ROLE MODELS



Odunayo Eweniyi

- A Nigerian computer engineer, entrepreneur, and activist
- Eweniyi graduated from Covenant University in 2013 with a degree in Computer Engineering
- She is the co-founder and Chief Operations Officer of PiggyVest, a secure online savings platform
- In 2019, Eweniyi was on *Forbes Africa's 30 under 30 Technology List*



Eloho Omame

- Graduate of the London School of Economics and has an MBA from London Business School
- Co-founded FirstCheck Africa in 2021 with Odunayo Eweniyi
- She is known best for her commitment to gender and inclusion in the venture capital (VC) sector in Africa

STEM ROLE MODELS



Eunice Biritwum

- Born and raised in Tema, Ghana
- Obtained her bachelor's and master's degree in electrical engineering from Iowa State University
- Served as a technical adviser for the creation of Women in Energy (WiE) Ghana and the chairperson of the executive committee of the Executive Women Network
- Currently serves as a Power Planning Manager for the West Africa Energy Program



Monica Senanu

- Director, Legal & Board Secretary for Ghana Grid Company Limited (GRIDCo)
- She provides legal oversight on issues related to the national grid in Ghana
- She is a board member of Women in Energy (WiE) Ghana, a platform that seeks to advance women's leadership and participation in Ghana's energy sector



Grace Alele-Williams

- Was a Nigerian professor of mathematics education
- Made history as the first Nigerian woman to receive a doctorate, and the first Nigerian female vice-chancellor at the University of Benin
- Made significant contributions to the development of education in Nigeria
- In February 2014, she was one of 100 people to receive the Centenary Award, that recognizes contributions of Nigerians to socio-cultural, economic, and political development of the country in the last 100 years



Marie Françoise Ouedraogo

- A Burkinabé mathematician, and first Burkinabé woman who defended a thesis in mathematics
- From 2005 to 2008 Ouedraogo served as the permanent secretary of the national policy of good governance
- In 2009, she became the president of the African Mathematical Union Commission on Women in Mathematics in Africa

STEM ROLE MODELS



Rebecca Cole

- Graduated from medical school in 1867
- Became a public health advocate, physician, and hygiene reformer in the U.S.
- Opened the Women's Directory Center with Charlotte Abbey, providing medical and legal services to women in need
- Worked as a doctor and public health educator for 50 years while raising five kids

STEM ROLE MODELS



Mae Jamison

- First ever African American woman to travel to space
- Was a doctor for the Peace Corps for two years after graduating with a medical degree from Cornell University
- In 1987, joined NASA's astronaut corps
- Orbited the earth from September 12th to 20th in 1992 with the STS-47 missions
- A year later, founded a tech research company and established a non-profit educational foundation that began the 100 Year Starship program funded by DARPA (Defense Advanced Research Projects Agency)
- Has been inducted into both the National Women's Hall of Fame and the International Space Hall of Fame



Ethel Coffie

- Ghanaian Information Communication Technology (ICT) entrepreneur
- Founder of Women in Tech Africa, which has over 30 members in African countries and the diaspora
- Founded EDEL Technology Consulting and initiated the first Pan-African Women in ICT meeting
- Supports women in ICT with her wealth of technical and commercial skills
- Named as one of the top 5 women making an impact in IT in Africa

STEM ROLE MODELS



Edith Mala Diop

- She obtained her scientific baccalaureate in 2004, at the Lycée Blaise Pascal in Abidjan.
- She joined the Aeronautical Institute Amaury de La Grange, France, the best French aeronautical private school.
- She was, at 23 years old, the youngest pilot of the Air Ivoire company.
- She flew, for 4 years and a half, the A 340-600, the longest plane in the world until the arrival of the Boeing 747-8.
- Today, she is the only Ivorian woman to be a long-haul and cargo pilot.
- She has worked for Air Ivoire, Senegal Airlines and is currently with Qatar Airways.
- She is one of the few female pilots, the proportion of female pilots in the world being only 5%.

RESOURCES USED

Resource	Resource Location
STEM Careers	https://dodstem.us/explore/career/?careerType=engineering#carousel
Career Explorer	https://www.careerexplorer.com/careers/engineer/personality/
Math STEM Activities	https://www.sciencebuddies.org/stem-activities/perimeter-magic-triangle
Math STEM Activities	https://teachbesideme.com/elementary-stem-projects/
West African Women in Tech	https://www.vogue.in/culture-and-living/content/west-africa-women-technology-industry-professionals
STEM Activities	https://thestemlaboratory.com/stem-activities-for-kids/
Technology STEM Activities	https://za.pinterest.com/harassedmomof4/technology-stem-activities/

RESOURCES USED

Resource	Resource Location
Coding Activity	https://www.pinterest.com/pin/242420392435427252/
Binary Code Definitions	https://en.wikipedia.org/wiki/Binary_code
Archimedes Ostomachion	https://en.wikipedia.org/wiki/Ostomachion
Tangram Definition	https://en.wikipedia.org/wiki/Tangram
Tangram Pintables	https://etc.usf.edu/clipart/74400/74405/74405_tangram_w_lg.gif
UN Sustainable Development Goals	https://www.un.org/sustainabledevelopment/development-agenda/